In the collection of skulls and mandibles under examination all the dentures were complete or nearly complete at death. Owing to the primitive methods of burial, with a few notable exceptions the specimens are now partially or wholly edentulous.

All the teeth peresent, regardless of condition, have been where possible, carefully measured in millimetres after the method advocated and used by the late Dr. G. V. Black of Chicago, and the measurements checked and tabulated in tables I and II. Average and greatest measurements will be found side by side for comparative purposes with similar measurements made and compiled by Dr. Black from a very large number of miscellaneous teeth collected by him.

A critical study of the teeth and jaws of the Eskimo is instructive and interesting. The dental arches are large and beautifully formed, approaching closely to the normal ideal Caucasian type as presented by Selenka and Röse.. (2) The curve of the arch is in all

2. Osborne, H. F. Evolution of Mammalian Molar Teeth. Macmillan Co., New York, 1907.

cases semi-elliptical and numerous measurements and calculations made indicate that it is almost mathematically accurate. In measuring the maxillae, a point that has hitherto, as far as I am aware, escaped notice was observed, namely--that the anterior palatine foramen is located exactly as the focus of the ellipse. The arches are broad and short,

the greatest breadth or minor axis of the ellipse being in the neighbourhood of the first and second molars, the third molars and tuberosities of the jaws lying on the inward falling, backward curve with a proportional decrease in breadth in this region. To one accustomed to the malocclusions of the civilized races the symmetry of the dental arcade in these Eskimo jaws is striking. Only the slightest trace of irregularity is in evidence in two cases--in one the canines, in the other a pre-molar being slightly out of alignment."

26: Ritchie--59 [2] (1913-18) 1923 Copper Eskimo
116, 141

"The occlusion in this race seems to be universally prosharmotic, i.e., the teeth meet edge to edge. When this condition maintains, the cusps of the premolar and molar teeth are usually short and the occlusal plane is flat or faintly curved in the antero-posterior direction. Such an arrangement permits of greatly extended forward and lateral excursions of the lower jaw as contrasted with the restricted movements of Caucasian dentitions where a more or less pronounced overbite of the upper teeth with a markedly curved occlusal plane, and length of tooth cusp developed accordingly, is the rule with few exceptions. But an edge to edge bite has far-reaching consequences; no matter in what race it is found the wear of the teeth is pronounced. In the Eskimo it reaches the extreme. Here, at middle age, the crowns of the incisors in many cases are completely worn away; the cusps of the second and third molars have disappeared; and, in the first molar and premolar region in the maxilla the entire lingual and occlusal portions of the teeth from the buccal marginal ridge to the cervical border of the lingual surface have been ground away, leaving oblique planes which meet and occlude with their counterparts in the mandible where the buccal aspect of the teeth has been removed almost to the same extent, leaving the sharp occlusal margins of the lingual enamel plates intact and highly polished flat surfaces bevelled almost to the buccal gum margin. (See Plates II, III, IV and VI, Cat. No. XIV, F. 4."

26: Ritchie--64 (1913-18) 1923 Copper Eskimo
116, 141

"Coincident with this extreme wear of the teeth the dental pulps have taken on their original function with conspicuous success. Sufficient new dentine of fine quality has been formed to obliterate the pulp chambers and in some cases even the root canals of the teeth. This new growth of tissue is found in every case where access to the pulp chambers has been threatened. There has therefore been no destruction of the pulps through infection and consequently alveolar abscesses are apparently unknown. Perhaps this is just as good a place as any to mention the fact that in all the teeth examined there is not the slightest trace of caries. Salivary calculus too, even in the oldest skulls, with one exception which will be referred to later, is entirely absent, as is also any trace of pyorrhoea, or resorption of the alveolar margins. These latter, however are thicker than those of civilized races and the blood supply is abundant."

26: Ritchie--64 [2] (1913-18) 1923 Copper Eskimo
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"An edge to edge occlusion has a further result which is conspicuous in a very large percentage of the skulls examined. This is the shallow broad glenoid fossa and the flattened eminentia articulatis which are typical of the Eskimo race. A reference to the plate will show how pronounced these characteristics are. It has been shown by eminent dental authorities (3) that the movements of the mandible during mastication are governed

3. Wilson, G. H. The Anatomy and Physics of the Temporo-Mandibular Joint. Journal of the National Dental Association, Huntington, Indiana, Vol. VII, No. 5, May, 1920; Vol. VIII, No. 3, March, 1921.

by the guiding action of the canine teeth and the inclined planes on the cusps of the premolars and molars. The varied actions of the condyles are the result of these movements and not their cause. As a corollary to this it may be said that the depth, form and extent of the glenoid fossa will vary according to the antero-posterior curvature of the occlusal plane and the extent of overbite exhibited by the anterior teeth with consequent restriction or non-restriction of movement as the case may be. In connection with this important point it might be well to point out that the anatomy text-books are undoubtedly wrong when the state that the mandible is a lever of the third class. (3)"

"By reference to tables I and II, it will be seen that the average measurements of the Eskimo teeth tend to be greater than those of the more civilized races. This is particularly true in the molar series which, unlike the civilized dentition, tends to revert to the generalized mammalian type where the molars increase in size in the antero-posterior direction. The teeth as a whole are more symmetrical and stick closer to the ideal typal forms than do those of the white races. There is in these jaws no sign of extremes in root development; nor, with the exception of the third molar, where variation is world wide, is there any indication of the fusion of molar roots spoken of by Wingate Todd (4) as common in the Eskimo. Prominence of the lingual molar roots,

4. Todd, T. Wingate. The Teeth of Primitive Man. Cleveland Medical Journal, Vol. XIV, April, 1915.

spoken of by Knowles (5) is nowhere greater than might be expected. In my opinion in

5. Knowles, F.H. S. The Glenoid Fossa in the Skull of the Eskimo. Geological Survey of Canada, Museum Bulletin No. 9, Anthropological Series No. 4, Ottawa, 1915.

individual Eskimo teeth there is far less variation from the mean than in any of the civilized races, and in this race we have the finest typal forms of teeth and the best dentitions in the world. Owing to their food habits (6, 7) I am strongly inclined to think

6. Nansen, F. Eskimo Life. London, 1893.

7. Whitney, H. Hunting with the Eskimo. New York, 1910.

that during the lapse of time not only the jaws but the teeth have been growing progressively larger."

26: Ritchie--64 [4] (1913-18) 1923 Copper Eskimo
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"One or two other facts are worthy of notice. An examination of the maxillary sinuses shows that in no case is there a projection of the roots of the molars or premolars into them. It was further noted that these sinuses are extremely large, with walls so thin as to be translucent. Apart from their function as resonating chambers, with the ample blood supply and fatty tissue of the cheeks covering them, it occurred to me that they might act as reservoirs for warm air which would aid materially the mucous membranes of the nose in the process of respiration when temperatures are low."

"In the mandibles of adult individuals a pronounced reinforcement of the alveolar process on the lingual sides of the premolar teeth which gradually vanishes as the molar series is reached is to be noted. This extraordinary growth of bone tissue (in specimen F. 31 it attains a thickness of 11 mm. below the 2nd premolar), is peculiar to the Eskimo. Hrdlicka states that -- 'it is undoubtedly [65] of functional origin the result of extraordinary pressure along the line of teeth most concerned in chewing.' (8) This growth may

8. Hrdlicka, A. Contribution to the Anthropology of the Central and Smith Sound Eskimo. Anthropological Papers of the American Museum of Natural History, Vol. V, Part II. Washington, 1910. (Quoted by Knowles, vide supra, p. 10

be clearly seen in Plates IV and V. Hrdlicka advances no facts in support of his statement and consequently one may consider it as merely a plausible guess. While it may seem like temerity to take issue with so great an authority, nevertheless for several reasons, chiefly dynamical, I believe he is wrong. In the first place pressure on the teeth is met and counteracted, not by the sockets of the teeth, but by the resiliency of the tangential and other fibres of the peridental membrane. (1) Only indirectly are the

1. Black, G. V. Dental Anatomy. S. S. White Co., Philadelphia, 1902.

alveoli concerned. In the second place the pressure is greatest at and near its point of application, viz., on the molar series, and it is here that the reinforcement is either slight or wanting. In this region, too, in the maxilla, the roots of the teeth are in close relation to the floor of the antrum and there is no trace of thickening of that structure to withstand the pressure."

26: Ritchie--65 (1913-18) 1923 Copper Eskimo
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"In the premolar region where the bone development is greatest, if it be argued that the growth is due to inward lateral pressure on the teeth, then since, the pressure is equal and outward on the corresponding teeth of the maxilla, one would naturally expect a corresponding reinforcement on the buccal surface of the alveolus above these teeth; but such is not the case.

A critical study of the mandibles--all of adult age--where the alveolar reinforcement occurs, shows that not only the angles but the horizontal rami are strongly everted, the lower margin of each jaw forming a very symmetrical parabolic curve. The alveolar ridge of the horizontal rami consequently lies markedly to the lingual of the lower margins so that the teeth are suspended by means of the alveolar process within the jaw, whereas ordinarily they would be placed directly upon it. In other words, owing to the strained form of the mandible, from necessity the alveolar process has altered its position. It is no longer possible to arrange it and the teeth over the jaw proper without increasing the size of the arch to such an extent as to throw it out of proportion with the rest of the face (Plate IV, Cat. No. XIV, H 4)."

"With the beginning of eversion as a result of enormous development in the muscles of mastication concerned, the dynamics of the mandible have changed from normal. After studying the forces involved and their mode of action I have come to the conclusion that when the jaws are forcibly closed the horizontal rami are under a tortional stress which tends to evert the lower and invert the upper margin of the bone. This effect is greatest in the premolar region and since the alveolar ridge is weakened by the sockets of the teeth a compensatory growth of bone is provided on the lingual alveolar wall in an effort to counteract the action of the powerful muscles involved. Plate IV shows very beautifully the changed relations from the ordinary that exist between the molar teeth, the coronoid process and the angle of the jaw. The thickness of the bone in the bicuspid region should be noted--on the right side is 18.3 mm. while the lingual space between the rami at the same point is only 18.5 mm."

26: Ritchie--65 [3] (1913-18) 1923 Copper Eskimo
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"There are other points of interest in the Eskimo dentition. The lower second molar frequently carries five cusps and the third molar is occasionally so inverted that the upper half of the buccal surface occludes with the upper teeth. Variation, too, is not entirely absent in the Eskimo. Frequently the third molars vary appreciably in size on the two sides of the mouth, and in one case (F-1) the upper lateral incisors are congenitally absent. In this skull, too, the teeth are plentifully coated with tartar, probably due to disuse owing to an osteitis of the temporo-mandibular joints (see drawing of the glenoid fossae).

F-19 is the mandible of a child, probably between five and six years of age. A close examination seems to indicate that the permanent teeth erupt rather earlier than is the case in the civilized races, where more extended observations have been possible."

According to Professor Todd (4) in the maxilla, 'the distance between the outer

4. Todd, T. Wingate. The Teeth of Primitive Man. Cleveland Medical Journal, Vol. XIV, April, 1915.

borders of the second molar teeth in the English race averages 58 mm.; the length measured from a point between the upper central incisors to midway between the posterior borders of the third molars is 54 mm.; the area of the hard palate is about 2,600 sq. mm. The lower dental arcade has a length of 53 mm., a breadth between the outer borders of the third molars of 68 mm., and an area of 2,700 sq. mm.' In the Eskimo the average breadth across the molars in twenty-two maxillae measured, was 62.8 mm., the greatest measurement being 68.8 mm. The length of palate to the borders of the third molars, in nine specimens, averaged 44.3 mm.; the greatest being 53 mm., and the least 32 mm. In nine mandibles measured, the breadth at the third molars averaged 65 mm. and the length 51 mm. The areas mentioned by Todd may easily be calculated from the figures given and the area formula of the ellipse.

My thanks are due to Dr. J. Stanley Bagnall for his assistance in making measurements and compiling tables I and II, and in the taking of casts of the glenoid fossae."